Duxbury Beach

Duxbury Clipper Wednesday, August 25, 1999

The Origins of Duxbury Beach

(This article is reprinted from a recent issue of Beach Soundings, the newsletter of the Duxbury Beach Preservation Society. – Ed.)

The Coastal Current Theory of Beach Creation — Part I

With the possible exception of geology buffs, those who cross the bridge to the 4.79 mile beach to swim, hike, ride, dig shellfish, or just sit in the sun most likely exult in their good fortune to enjoy this magnificent recreational resource, without pondering its origins. Charles "Al" Krahmer, a Duxbury Beach Reservation trustee who has been an activist volunteer and manager of the beach for over 30 years, is just such an exception. He has compiled his first-hand observations and the results of several scientific studies in a report that will be summarized in three parts in *Beach Soundings*. At mid-century, the accepted theory of origin of Duxbury's barrier beach was that its sands were carried south from the Scituate cliffs by the southerly coastal current and deposited on Duxbury.

At first blush, the theory seems plausible. A continuous supply of sand is fundamental to the coastal current theory in order to create, sustain and rebuild the beach after severe storms. But two Army Corps of Engineers reports cast doubt on this first theory of origin. A 1988 study that attempted to identify the source of sand that accumulated and required dredging every year or two in the Green Harbor Channel proved that the necessary sand was not moving toward Duxbury from the north. Not only was there no evidence of sand moving over the Farnham Rock ridge, but also in a few areas where there appeared to be sand, the deposits were so old they were too hardened to obtain core samples.

Al Kramer reinforces these findings with his observations that standing on shore at low tide in Green Harbor there is a ridge of rocks extending east to Farnham Rock, but no sand. And only rocks are to be seen on a calm day's boat excursion over Farnham Rock ridge.

A 1960 Corps of Engineers report concluded that "these beaches (including Duxbury Beach) have no dominant long-shore transport pattern because they are oriented perpendicular to the dominant storm wave approach (from the northeast)."

Thus, both the dearth of evidence of moving sand and the orientation of Duxbury Beach contravene the early theory that a continuous sand supply was and is carried by the southerly coastal current from the Scituate cliffs.

Duxbury Beach

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Origins of Duxbury Beach

(Here is Part II of an article reprinted from the Spring/Summer and Fall/Winter 1999 issues of Beach Soundings, the newsletter of the Duxbury Beach Preservation Society. – Ed.)

The Double Tombolo Theory — Part II

If two Army Corps of Engineers' studies and the personal observations of long-time Duxbury Beach Reservation Trustee, Charles "Al" Kramer, threw cold water on an early theory that Duxbury Beach was formed by sands carried south from the Scituate cliffs, is there a supportable explanation for the creation of the beach?

Al Kramer explores a second double tombolo theory in his writings on the origins of the beach, based on his own observations as an activist volunteer and manager of the beach as well as a comprehensive study of Duxbury Beach carried out by Dr. Duncan Fitzgerald and three associates of the Geology Department of Boston University in the early 1980's. The Fitzgerald study, which included measuring currents during northeast storms, determined that currents flowed parallel to the beach, both north and south. From his investigations, Dr. Fitzgerald positioned that the beach deposits of sand, stone and rock boulders moved south from Green Harbor and north from the Gurnet and met to form a barrier split or double tombolo.

A second comprehensive study carried out in 1989 by another Boston University academic, Dr. Michael Hill, endorsed the double tombolo theory. Beachgoers may want to enhance their light summer reading lists with the Fitzgerald study, entitled "Coastal Processes and Hazards of the Plymouth County Shoreline" and Dr. Hill's report, entitled "The Stratigraphy, Hydrodynamics and Sediment Distribution of a Glacially Influenced Mesotidal Back Barrier: Plymouth, Kingston, and Duxbury Bays, Massachusetts."

There are more questions than answers, however, when the tombolo theory is tested against many years of practical experience in managing Duxbury Beach. As Al Kramer puts it, if the beach theoretically migrated in part south from Green Harbor, how is that theory sustainable when the Army Corps of Engineers' study found that Green Harbor is a bedrock outcropping with little or no sand? And if the beach migrated north from Gurnet, why is the largest amount of sand at the Plum Hills and the rockiest part of the beach just north of Plum Hills? If the beach was migrating northward, why would this area be so lacking in sand? Moreover, the northerly current along the south part of the beach occurs only when the wind is from the northwest to northeast. Yet a continuous process is necessary to sustain the beach.

A fundamental question remains as to the backbone stones and rocks of the beach. Duxbury Beach, unlike typical barrier beaches comprised primarily of sand, is one of only two Massachusetts glacial barrier beaches made up of stone, rock and boulders. If, as Al Kramer maintains, the coastal currents as measured by Dr. Fitzgerald lack the strength to move large storms, rocks or even gravel, and storm waves do not pound the beach at the oblique angle necessary to roll stones and rocks down the beach, the assumptions underlying the trombolo theory break down. As Al Kramer asserts, ""Big storms remove material from the beach and deposit it offshore; they do not bring material to it."